Science Arena Publications
Specialty Journal of Agricultural Sciences
Available online at www.sciarena.com
2015, Vol, 1 (2): 28-33

Influence of various growing substrates on growth and flowering of potted miniature rose cultivar "Baby Boomer"

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ABSTRACT: Right choice of the suitable medium contributes a lot in the successful ornamental flower production. The present study was conducted to evaluate the effect of various growing substrates on the growth and development of miniature rose cultivar "Baby Boomer". Four different growing substrates with variable composition and combinations with peat, farm yard manure, silt and leaf mold and their combinations with each other were compared using garden soil as a control. There were 4 treatments in the experiment and each treatment was consisting of 10 plants and these plants in pots were arranged according to completely randomized design (CRD) which was replicated thrice. Data regarding different growth attributes including plant height, number of leaves per plant, number and length of branches per plant and yield attributes included number of flowers per plant, diameter of flowers, fresh and dry weight of flowers were recorded and analyzed statistically by using Fisher's analysis of variance technique and means were compared for significance by using Least Significant Difference (LSD) test at 5% probability level. Results indicated that the medium consisting of leaf compost exhibited overall better performance as compared to other media for various vegetative growth characteristics including plant height, number of leaves per plant, number and length of branches per plant and some reproductive growth parameters like number and diameter of flowers, and while the medium consisting of peat also showed better results to produce maximum fresh and dry weight of flowers.
Key words: Flowering, growth, miniature roses, organic substrates, yield.

Introduction

Roses are one of the beautiful and most popular flowers among many floriculture crops of the world. The rose derived from the Latin word "Erose" meaning the "God of love" (Rajesh and Ramesh, 1999). Rose belongs to genus *Rosa*, sub family is Rosoideae and family Rosaceae (Man et al., 2010). The rose has 200 species and more than 20,000 varieties (Gauchan et al., 2009). Miniatures roses are a type of roses that are smaller in mass. They are perfect for glass boxes, pots and containers, typically grown to about 35 centimeter and can have double or semi-double flowers (Cushman et al., 1994). These are enormous to add colors and scented to a home or closed garden.

The potted production of different types of plants especially miniature rose is most popular in urban dwellings. For this garden soil, leaf compost and peat are the growing substrates preferably used for the container production of both annual and perennial ornamental plants (Tariq et al., 2012) and are very important for the plant growth and development. These materials also increase the microbial activities in soil which are essential to increase and fulfill the nutritional requirement and it also reduces the nitrogen losses

(Simpson and Bode, 1980). The media significantly affect the plant growth when leaf compost with nitrogen fertilizer use in growth media (Worrall, 1981).

Sand for potting mixes is also best as it provide maximum air space for the plant growth and it has neutral pH which is best for the plant growth and it is heavier in weight so it supports the plant. It is cheap and readily available potting mixes. On the other hand, farm yard manure is good source of nutrients for the plants but required in large amount as compared to other fertilizer (Makinde et al., 2007) but less costly as compared to other fertilizer and it work for longer period of time. It also activates the soil microbes which increase the fertility status of the soil (Ayuso et al., 1996)

Peat is widely used as substrate around the world for potted plant production affecting the nutrients, pH, biological stability, absorption capacity and also effects the dissolved organic matters in the soil (Caballero et al., 2007). Leaf composts contain biologically active substrates which stimulate and regulate the growth of plant (Grappelli et al., 1987). The combination of leaf compost and peat moss is very beneficial for plant growth. The water holding capacity increase by peat and compost enhance the nutrient holding capacity of the growing media (Chong, 2005). Plants grow on compost based substrates give the maximum growth and enhance the nutritional values (Ostos et al., 2008). It also improves the chemical, physical and biological properties of a soil due to high organic matter contents and increase the porosity, water holding capacity and infiltration rate of a soil. It protects the plant roots and seedling from diseases due to beneficial organism present in the compost (Greer, 1998).

With the development and the expansion of the horticultural industry the availability of the suitable media is going to be limited and the type and composition of the available substrates varies in various countries. Moreover the available substrates are going to be expensive day by day and the demand also increases so, greater need is required to evaluate the good substrate for the plant growth.

The present research was carried out to evaluate the influence of different growing media with different combinations on the growth and flowering of miniature roses. Soil, peat moss, leaf manure and farm yard manure and their combination in different proportion was used. The main objective was to investigate the response of miniature roses towards different potting media with different proportions.

Material and methods

Present research project was carried out at Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture Faisalabad during the year 2010-2012. A commercial variety of miniature rose Baby Boomer was obtained from the Ever Green Nursery of Faisalabad and plants (one year old) were transplanted into the pots which were filled with different types of growing substrates including garden soil, peat moss, silt and leaf compost with different combinations to increase the vegetative and reproductive growth of roses by different growing substrates. A complete list of chemical analysis of these growing substrates is shown in table 1. Other management practices like irrigation, weeding, and pesticide application were same for all treatments. Plants were arranged according to completely randomized design (CRD) with 10 plants in each treatment that was replicated thrice. Data was analyzed by using Fisher's analysis of variance technique. Means were compared for significance by using Least Significant Difference (LSD) test at 5% probability level (Steel et al., 1997).

Table 1. Chemical analysis report of different growing substrates

Treatment	Detail	EC mS/cm	pH	Phosphorus(ppm)	Organic matter (%)	Available Potassium (ppm)	Nitorgen (%)
T_0	Garden Soil	3.39	8.12	8	0.49	180	0.49
T_1	FYM + Silt (1:1)	3.41	7.62	16	0.73	220	0.14
T_2	Leaf Compost	3.30	7.85	12	0.72	190	0.58
T_3	Peat Moss	3.30	7.9	11	0.68	200	0.44
T_4	FYM + Leaf Compost (1:1)	3.41	7.58	18	0.86	260	0.24

Results and discussion

Vegetative characteristics

Plant height (cm)

Composed data pertaining to plant height were subjected to statistical analysis. Analysis of variance illustrated highly significant ($P < 0.05$) results at 5% level of probability. Treatments means were subjected to Least Significant Difference (LSD) test and each treatment showed different response towards plant height. Treatment combination T_2 consisting of leaf compost give maximum plant height 75.44 cm followed by T_0 (garden soil) yielding 72.22 cm and T_3 (peat) 68.11 cm while 66.88 cm plant height was observed in T_4 (farm yard manure + leaf compost) as shown in table 2. The response of T_1 (farmyard manure + silt) was not very good as it resulted in minimum plant height 63.88 cm. Growth substrate provides all the essential nutrients and water to the plants, which is very essential to obtain the maximum height. If any nutrient in the selected growing medium is absent or in less amount then it reduced the plant growth and development. Results showed that the leaf compost and peat show better quantitative effects on plant height as compared to the other treatments because of high nutritional level in peat and leaf compost. Our these results are matched with the findings of Fred et al. (1997) who evaluated that when chrysanthemum grows on leaf compost substrate, then it produce maximum plant height. Results also confirmed the results of Fascella (2003) that leaf compost produce maximum plant height in *Ruscus hypophyllum.* These results are also in line with the results of Kiran et al. (2007) and Abo-Rezq et al. (2009) who proved that leaf mold is very important for plant height.

Number of leaves per plant

Results of this experiment showed that T_2 (leaf compost) give maximum number of leaves per plant 259.78 followed by T_0 (garden soil) and T_3 (peat) having 256.44 and 254.56 number of leaves per plant while T_1 (farmyard manure + silt) produced minimum number of leaves 244.33 as compared to other treatments as shown in table 2. Environmental conditions readily affect the number of leaves in plants and any fluctuation in environmental conditions effect the number of leaves/plants. If the soil contain a large number of nitrogen then the plant contain a large number of leaves. Nutritional level play a major role in increasing the number of leaves per plant. Ahmed et al. (2004) confirmed our results and studied that by adding leaf mold in the potting media increases number of leaves per plant. Findings of Younis et al. (2007) also matched with our finding that sand + silt + leaf mold + spent compost produce maximum number of leaves in *Euphorbia pulchirima*. Results are also matched with the findings of Fascella (2003) that leaf compost produce maximum number of leaves in *Ruscus hypophyllum.* Grassotti et al. (2003) also confirmed our results and found that when coconut coir used as substrate then it produce maximum number of leaves per plant.

Number of branches per plant

Each treatment showed different response towards number of branches per plant. T_2 (leaf compost) produced maximum number of branches 16.44 followed by T_0 (garden soil) 15.55 and T_3 (peat) 14.33 while T_1 (farmyard manure + silt) produced minimum number of branches 10.44 as compared to other treatments as shown in table 2. Results of this experiment are in line with the findings of Fascella (2003) that leaf compost produce maximum branches per plant in *Ruscus hypophyllum*. Riaz et al. (2008) found that coconut compost produce the maximum number of branches/plant. Kiran et al. (2007) proved that leaf compost is very important for improving all vegetative growth parameters of the plants. Shackel et al. (1999) also concluded that growing substrates which contain high nitrogen level produce maximum branches/plant.

Length of branches (cm)

T_2 (leaf compost) produced maximum length of branches 59.55 cm followed by T_0 (garden soil) having 57.55cm and T_3 (peat) gave 55.44cm. T_1 (farmyard manure + silt) produced minimum length of branch 53.33cm as compared to other treatments as shown in table 2. T_2 (leaf compost) also produced best vegetative growth throughout the experiment due to the nutritional balance in substrate. This increase in growth rate might be due to the establishment of plant decomposition of organic contents in different types of growing media due to more availability of nutrient to plant and leaf compost provide nutrients to plant in decomposition form (Burgos et al., 2006). These result also matched with the findings of Chen et al. (2006)

who observed that the Lilium produced maximum number of branches when grow in leaf mold substrate as it increases the nutrient availability.

Table 2. Effect of different growing substrates on vegetative growth characteristics of miniature roses.

Treatments detail	Plant height (cm)	Number of leaves per plant	Number of branches per plant	Length of branches (cm)
T_0 (Garden Soil)	72.22^{ab}	256.44^{ab}	15.55^{ab}	57.55^{b}
T_1 (FYM + Silt)	63.89^{d}	244.33^{c}	10.44^{c}	53.33^{d}
T_2 (Leaf Compost)	75.44^{a}	259.78^{a}	16.44^{a}	59.55^{a}
T_3 (Peat Moss)	68.11^{bc}	254.56^{ab}	14.33^{ab}	55.44^{c}
T_4 (FYM+ Leaf Compost)	66.88^{cd}	251.78^{bc}	13.00^{bc}	54.22^{cd}

Reproductive characteristics

Number of flower per plant

Analysis of variance illustrates significant ($P< 0.05$) results at 5% probability level. Results of this experiment showed that T_2 (leaf compost) produced maximum number of flower 49.11 while T_1 (farmyard manure + silt) produced minimum number of flower 40.88 as shown in table 3. T_0 (garden soil) produced 47.22 and T_3 (peat) produced 44.33 flower per plant. Flower growth depend upon the environmental factors and if the soil contained a large amount of potasium and nitrogen then plant produce a large number of flowers. These results are in accordance with the Tallin et al. (2003) who concluded that when leaf manure and sand use as substrate for dahlia then it produces maximum number of flowers. Results also in line with the findings of Kiran et al. (2007) who used the leaf manure + sand + silt as growing media then it produces maximum number of flowers. Khan et al. (2002) also confirmed the result that gladiolus produce maximum flowers on sand + leaf mold substrate as it increases the nutrient availbility.

Flower diameter (cm)

Results showed that T_2 again performed better and gave maximum flower diameter (4.50 cm) followed by T_3 (peat) 4.40 cm and T_0 (garden soil) 4.26 cm. T_1 (farmyard manure + silt) produced minimum flower diameter 3.80 cm as compared to all other treatments as shown in table 3. Increase in flower diameter depends on the proper amount of potassium and nitrogen and if these nutrients found in large quantity then the large size flowers can be obtained. It was evaluated from the media analysis that T_2 (leaf compost) contain maximum amount of nutrients so that flower size was also maximum in this growing medium. Same results were obtained by Ahmed et al. (2004) and their findings indicated that by adding leaf mold in the potting media increase the flower size. Riaz et al. (2008) also concluded that coconut compost produced the maximum flower size. These results are also matched with the findings of Fascella (2003) that leaf compost produce maximum flower diameter in *Ruscus hypophyllum.* Kiran et al. (2007) also favored our results and studied that leaf mold is very important for flower size. Result of Tallin et al. (2003) also matched with our result and observed that Dahlia produced maximum flower size when grow in leaf manure + sand as it fulfill all the requirements of an ideal media for proper plant growth and development.

Fresh weight of flower (g)

Data regarding fresh weight of flower showed that T_3 (peat) produced maximum fresh weight 1.96 g followed by T_2 (leaf compost) 1.88 g while 1.77 g fresh weight was observed in T_4 (farm yard manure + leaf compost) as shown in table 3. T_1 (farmyard manure + silt) produce minimum fresh weight of flower that was 1.69 g. More weight of flowers indicated the good health of plants and it also represented that the plants were provided with adequate supply of nutrients and water. These results were matched with the finding of Nazari et al. (2008) who studied that when marigold grow on peat substrate, then it produced maximum fresh weight of flowers. These findings were in accordance with the results of Marchaent et al. (1996) who concluded that gerbera produces maximum fresh weight of flowers when peat was used as growing media as it increases the soil porosity which increased the water holding capacity.

Dry weight of flowers (g)

The dry weight of flowers is the mass of all its constituents excluding plants. Results of this experiment showed that T_3 (peat) also proved best regarding to maximum dry weight of flowers 0.66 g followed by T_2 (leaf compost) having 0.62(g) and T_0 (garden soil) having 0.61 g while 0.60 g dry weight of flower was observed in T_4 (farm yard manure + leaf compost) as shown in table 3. T_1 (farmyard manure + silt) produce minimum dry weight of flower dry 0.56 (g) as compared to other treatments. The result regarding flower dry weight showed that medium containing peat was better as compared to all other growth media. These results were in line with the results of Baiyeri and Mbah (2006) who found that maximum dry weight of flower produce by adding the peat in growth media. Result also matched with the findings of Vendrame et al. (2005) who observed that maximum dry weight of chrysanthemum flowers obtain when peat was used as a substrate as it increases the soil porosity for proper aeration during the growth and development of plants.

Table 3. Effect of different growing substrates on reproductive growth characteristics of miniature roses.

Treatment	Number of flowers/plant	Diameter of flower	Fresh weight of flower (cm)	Dry weight of flower (cm)
T_0 (Garden Soil)	47.22^{ab}	4.26^{bc}	1.83^{abc}	0.61^{b}
T_1 (FYM + Silt)	40.88^{c}	3.80^{d}	1.69^{c}	0.56^{c}
T_2 (Leaf Compost)	49.11^{a}	4.50^{a}	1.88^{ab}	0.62^{b}
T_3 (Peat Moss)	44.33^{bc}	4.40^{ab}	1.96^{a}	0.66^{a}
T_4 (FYM+ Leaf Compost)	42.55^{c}	4.13^{c}	1.77^{bc}	0.60^{b}

Conclusion

Contrasting comparisons of the performance of the various treatments was evaluated discriminately. Among all the substrates and their combinations, the leaf compost was best for producing highest vegetative and reproductive growth characteristics of the plants while peat proved best regarding fresh and dry weight of flowers. Leaf compost provides nutrients (nitrogen and potassium) in proper amount and optimum range of pH was also maintained in the substrate which is basic requirement of Baby Boomer growth in any medium. Thus it is suggested that leaf compost may be further recommended as standard substrate for Baby Boomer to maintain best growth and flowering.

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